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XXVI. *An Account of a new Electrometer, contrived by Mr. William Henly, and of several Electrical Experiments made by him, in a Letter from Dr. Priestley, F.R.S. to Dr. Franklin, F. R. S.*

DEAR SIR,

Read May 28, 1772. I THINK myself happy in an opportunity of giving you a species of pleasure, which I know is peculiarly grateful to you as the father of modern electricity, by transmitting to you an account of some very curious and valuable improvements in your favourite science. The author of them is Mr. Henly, in the Borough, who has favoured me with the communication of them, and has given me leave to request, that you would present them to the Royal Society.

In my history of electricity, and elsewhere, I have mentioned a good electrometer, as one of the greatest desiderata among practical electricians, to measure both the precise degree of the electrification of any body, and also the exact quantity of a charge before the explosion, with respect to the size of the electrified body, or the jar or battery with which it is connected; as well as to ascertain the moment of time, in which the electricity of a jar changes, when, without making an explosion, it is discharged by giving

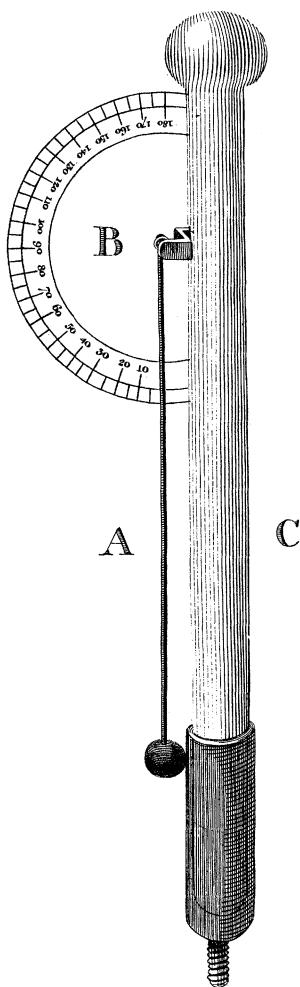
giving it a quantity of the contrary electricity. All these purposes are answered, in the most complete manner, by an electrometer of this gentleman's contrivance, a drawing of which I send you along with the following description.

The whole instrument is made of ivory or wood, [Tab. XI.] (a) is an exceeding light rod, with a cork ball at the extremity, made to turn upon the center of a semicircle (b), and so as always to keep pretty near the limb of it, which is graduated: (c) is the stem that supports it, and may either be fixed to the prime conductor, or be let into the brass knob of a jar or battery, or set in a stand, to support itself.

The moment that this little apparatus is electrified, the rod (a) is repelled by the stem (c), and consequently begins to move along the graduated edge of the semicircle (b); so as to mark with the utmost exactness, the degree in which the prime conductor, &c. is electrified, or the height to which the charge of any jar or battery is advanced; and as the materials of which this little instrument is made are very imperfect conductors, it will continue in contact with any electrified body, or charged jar, without dissipating any of the electricity.

If it should be found, by trial in the dark, that any part of this instrument contributes to the dissipation of the electric matter, (which, when the electrification was very strong, I once observed mine to do) it should be baked * a little, which will presently prevent it. If it is heated too much, it will not receive electricity readily enough; and then the motion of the index will not correspond with sufficient

* Warmed a little, to dry off the damps, particularly from the index.



The Electro-meter is found by experience to be the most perfect, when the arms and the under arc of B are made very smooth with C merely paper. The ball should be Cork, the graduated plate B very ad the divisions on that surface are more liable than on wood, to

exactness, to the degree in which the body to which it is connected is electrified ; but this inconvenience is easily remedied, by moistening the stem and the index, for the semicircle cannot be too dry.

I find by experience, that this electrometer answers all the purposes I have mentioned, with the greatest ease and exactness. I am now sure of the force of any explosion before a discharge of a jar or battery, which I had no better method of guessing at before, than by presenting to them a pair of Mr. Canton's balls, and observing their divergency at a given distance ; but the degree of divergency was still to be guessed at by the eye, and the balls can only be applied occasionally ; whereas this instrument, being constantly fixed to the prime conductor or the battery, shews, without any trouble, the whole progress of the charge ; and, remaining in the same situation, the force of different explosions may be ascertained with the utmost exactness before the discharge.

If a jar be loaded with positive electricity, and I want to know the exact time when, by attempting to charge it negatively, it first becomes discharged, I see every step of its approach to this state by the falling of the index ; and the moment I want to seize, is the time when it has got into a perpendicular situation, which may be observed, without the least danger of a mistake. Accordingly I find that, in this case, not the least spark is left in the jar. If I continue the operation, the index, after having gained its perpendicular position, begins to advance again, and thereby shews me the exact quantity of the opposite electricity that it has acquired.

Considering the admirable simplicity, as well as the great usefulness of this instrument, it is something surprizing that the construction should not have occurred to some electrician before this time. Nollet's and Mr. Waits's invention of threads, projecting shadows upon a graduated board, resembled this apparatus of Mr. Henly's, but was a poor and awkward contrivance in comparison with it ; nor was Richman's gnomon, though a nearer approach to this construction, at all comparable to it ; and the ingenious author of it had no knowledge of either of those methods when he hit upon this.

I have made a receptacle for this instrument in my prime conductor, and I have also a pedestal in which I can fix it ; and by means of which I can very conveniently place it on the wires of a battery.

In either of those situations it answers almost every purpose of an electrometer, without removing it from its place.

I doubt not that you and all other electricians will join with me in returning our hearty thanks to Mr. Henly for this excellent and useful instrument.

Many of the effects of my battery, in breaking of glass, and tearing the surface of bodies, Mr. Henly performs by a single jar, only increasing the weight with which the bodies are pressed, while the explosion is made to pass close under them.

By this means he raises exceeding great * weights, and shatters strong pieces of glass into thousands of the smallest fragments ; he even reduces thick plate glass by this means to an impalpable powder. But

* Frequently six pounds Troy.

what is most remarkable is, that when the pieces of glass are thick, and strong enough to resist the shock, they are marked by the explosion, with the most lively and beautiful colours, generally covering the space of about an inch in length, and half an inch in breadth.

In some of the pieces which he was so obliging as to send me, these colours lie all intermixed and confused ; but in others I observe them to be disposed in prismatic order, in lines parallel to the course of the explosion, and in some (as N° 1.) I have counted three or four distinct returns of the same colour.

He has lately informed me, that, since he sent me this piece, he has struck these prismatic colours into another mass of glass, in a still more vivid and beautiful manner, the colours shooting into one another. This effect, he says, was produced by making a second explosion, without moving any of the apparatus after the first.

When the glass in which these colours are fixed is examined, it is evident that the surface is shattered into thin plates, and that these give the colours, the thickness of them varying regularly, as they recede from the path of the explosion.

In the middle of these coloured spots (as in N° 2.) some of these thin plates, or scales, are struck off, I suppose by the force of the explosion ; and with the edge of a knife they are all easily scraped away, when the surface of the glass is left without its polish (as in N° 3.)

The piece of glass on which I have marked these numbers, as well as that on which he has struck the

colours in a still more beautiful manner, Mr. Henly will present to the Royal Society, for the inspection of the members.

Besides these improvements, Mr. Henly has likewise, in a very ingenious manner, diversified several of the more entertaining experiments in electricity, particularly in his imitation of the effects of earthquakes by the lateral force of explosions; and he has also hit upon several curious facts, that, unknown to him, had been observed before by others: the following particular, however, I believe is new, exciting a stick of sealing wax, and using a piece of tin foil for the rubber, he found that it would electrify positively, as well as glass rubbed with silk and amalgama.

Wishing we had more such fellow labourers as Mr. Henly, I am,

DEAR SIR,

Your obliged

humble servant,

Leeds,
Oct. 26, 1770.

J. Priestley.